LOCAL VIDEO AND AUDIO NETWORK WITH AN OPTICAL DATA LINE

PRIORITY INFORMATION

This patent application claims priority to International patent application PCT/EP99/09954 filed December 15, 1999 and German patent application 198 58 493.8 filed December 18, 1998, which are hereby incorporated by reference.

BACKGROUND OF THE INVENTION

The invention relates in general to ~~the field of~~ automotive multimedia systems, and in particular to an automotive multimedia system ~~that includes~~ having a local network with several subscribers ~~who are~~ connected together into a ring network by an optical data line, to transmit and receive compressed data of various types.~~audio and/or video data as well as control data.~~

Local networks with several subscribers ~~who are~~ connected together into a ring network by an optical data line, to transmit audio, ~~and/or~~ video and/or ~~data as well as~~ control data are known, for example, from ~~the~~ European Patent ~~Application~~ EP 519 111 B1. The~~is~~ local network disclosed therein has several subscribers, some of which generate audio or video data and control data, and provide the data ~~feed these~~ into the ring network. These subscribers that generate such data are typically referred to as ~~called~~ data sources. Other subscribers to the network receive ~~from the network~~ the data intended for them from the network, and then present the data to a user, for example, ~~either~~ by acoustic or visual reproduction. These subscribers that receive such data are often referred to as data sinks.

The known local networks have various data sources such as, for example, a car radio, CD player, DVD player, or a TV tuner, which typically transmit their data uncompressed over the optical data line to the appropriate data sink, for example a car amplifier to which several loudspeakers are connected, or a screen which displays the uncompressed FBAS video signal. The subscribers to such a network input their data to the network independently of one another and thus sometimes simultaneously, and withdraw the data in the same manner. Consequently, such a network can accommodate only a few subscribers at any one time since the transmission capacity of the network over the data line is inherently limited.

Individual devices are known, for example a television~~,~~ having ~~which have~~ a TV tuner and picture tube in a housing, and which are connected to one another via a data line. Uncompressed video signals are transmitted through the~~is~~ data line (e.g., as FBAS signals), and are displayed on the picture tube. Device combinations are also known, for example a DVD player with a television set. With this combination, the compressed data stored on the digital video disk (DVD), which are coded, for example ~~among other ways,~~ according to the MPEG-2 standard, are read and ~~out, are~~ decoded and decompressed by an appropriate MPEG-2 decoder in the DVD player. ~~and thus are decompressed~~.~~–~~The decompressed data are then transmitted ~~as decompressed data~~ over the connecting data lines to the ~~standardized~~ television set~~.~~ which ~~The television set~~ reproduces and ~~/~~displays these decompressed data, for example as an FBAS signal, in accordance with the video data received by the TV tuner.

A problem with the prior art systems is that the data on the data network are not compressed and thus make inefficient~~ly~~ use of the bandwidth of the data line, and further requires the data sources to provide decompressed data to the data sinks.

What is needed is a data network that connects several devices together and transmits and

receives compressed data over the network.

SUMMARY OF THE INVENTION

An ~~Briefly, according to an aspect of the present invention, a motor vehicle~~ optical ring network for use, for example, in a motor vehicle, includes an optical data line that defines a ring network, a playback transducer and ~~at~~ least one data source ~~that is~~ connected to the optical data line, where the data source ~~and~~ provides compressed data onto the optical data line. The network also includes at least one data sink that is connected to the optical data line, and receives the compressed data from the optical data line. ~~and provides received compressed data indicative thereof.~~ The data sink includes a bit stream decoder that~~to~~ decompresses the received compressed data and provides the ~~a~~ decompressed data ~~signal indicative thereof~~ to the playback transducer.

The ~~inventive~~ local network ~~is ideally suited for automotive application. It~~ transmits audio ~~data~~ and video data in compressed form via the data line, and ~~it~~ has a single bit stream decoder, centrally situated at the respective data sink, for decompressing the audio and video data ~~conducted to it~~. This makes it possible to dispense with the prior art decoders located ~~previously present~~ at the various data sources, for example the bit stream decoder in the DVD player~~,~~ ~~which here is designed as an MPEG-2 decoder for the video data.~~ For example, if several such data sources are ~~to be~~ arranged in a network, it is now possible to dispense with the~~is~~ requisite ~~plurality of~~ bit stream decoders in each of the individual data sources as in the prior art. This ~~and thus to~~ reduces the attendant costs of the network. ~~with its subscribers. Only at the relevant data sink is~~ In the local network of this aspect of the invention, a single bit stream decoder is required ~~present~~ for decompressing the corresponding video data or audio data. As a result, ~~of this new realization,~~ the individual ~~components (i.e., the~~ data sources~~)~~ no longer need ~~can now make do without~~ their own bit

stream decoder for decompressing the data. By the assignment of such a bit stream decoder centrally to the relevant data sink, the components of the individual subscribers are distributed in a more efficient manner within ~~new and better way in~~ the network. Advantageously, this better utilizes the available data transmission capacity of the network, due to the transmission of compressed data instead of decompressed data. ~~-~~It also ~~In addition, it greatly~~ reduces the overall costs of the network. The various data sources can be implemented more economically at the expense of the data sinks, since the data sources can dispense with the relatively cost-intensive bit stream decoders. Further, ~~S~~since a ~~an inventive~~ local network typically ~~regularly~~ has a ~~much~~ larger number of data sources than data sinks, this facilitates ~~results in~~ the ~~above-mentioned marked~~ cost reduction~~s~~.

In one ~~a preferred~~ embodiment, the data sink with its bit stream decoder is ~~designed~~ separate from the data sources, ~~-~~and the compressed audio or video data are conducted to the data sink via the optical data line. This reduces the circuit complexity of the data sink, further reducing the costs of the ~~a~~ network. ~~-with such a data sink.~~ This also allows for ~~ensures that all~~ the compressed data conducted to the data sink to be ~~are~~ treated equally, and that no parallel input~~ted~~ audio or video data are treated preferentially.

The data connection between the data sources and the data sink with the bit stream decoder can be controlled by control data transmitted over the data line. This allows for the ~~ensures~~ reliable establishment of the data connections, the assignment of the data sink to the data sources, as well as control of the type of decompression. The bit stream decoder may be switched between several modes of decoding by the transmitted control data. This allows a single bit stream decoder to read several compressed data formats, and an appropriate switched state of the bit stream decoder can be chosen as needed (i.e., depending on the compressed data format used by the data source). The decoder may support video data compression formats such as MPEG-1, MPEG-2, and JPEG.

Another bit stream decoder can be switched to decompress various audio compression formats (e.g., AC-3, MPEG-1, and MPEG-2). This can further reduce the number of required bit stream decoders. It has proven beneficial to dispense with a collection of decoders for different types of compressed audio ~~data~~ and ~~for compressed~~ video data, since the compression methods used therein as well as the data structures for the audio and video data ~~are too~~ differ widely~~ent.~~, Also, ~~and~~ the audio ~~bit stream decoders~~ and video bit stream decoders can be collected together ~~only~~ with ~~very~~ relatively sophisticated organization and cost, which ~~would by far~~ cancels the theoretical cost advantage of further decoder reduction.

These and other objects, features and advantages of the present invention will become more apparent in light of the following detailed description of preferred embodiments thereof, as illustrated in the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

The FIGURE ~~illustrates~~ is a block diagram illustration of a local video and audio network with an optical data line.

DETAILED DESCRIPTION OF THE INVENTION

A local network 10~~0~~ includes a plurality of subscribers 12-15 ~~4~~ that may be ~~are~~ connected to one another in a ring by an optical data line 20~~5~~. Each of the subscribers 12-15 ~~1-4~~ includes an associated interface 22-25 ~~4-1, 4-2, 4-3, 4-4~~, respectively, and each interface 22-25 includes two connections to the optical data line 20~~-5~~ to establish the ring.

The ~~S~~subscriber 12 may be ~~is~~ a car radio that ~~and~~ forms a data source. As such, the radio 12 ~~This data source 1~~ receives a radio signal and delivers the received signal ~~this either~~ as uncompressed

audio data via its interface 22 ~~4-1~~ to the data line 20 ~~5~~ and thus to the network 10 for transmission to the associated data sink.~~,~~ Alternatively, ~~or~~ the audio signals of the radio program may be ~~are~~ conducted to an integrated bit stream encoder 30 ~~10~~, which converts the audio signals into compressed audio data and transmits the signals~~m~~, via the interface 22~~4-1~~, to the optical data line 20~~5~~. The AC-3 format is a suitable coding format for the audio signals.

Along with the audio data from the car radio 12, control data are also transmitted over the optical data line 20, which ensures the correct assignment of the audio data to the correct data sink (e.g., the subscriber 14 which may be an amplifier). In addition, an appropriate control signal ensures that the data sink 14 to ~~3~~ conducts the incoming data, inasmuch as these are transmitted as AC-3 compressed data~~,~~ to the corresponding AC-3 bit stream decoder 32, which decompresses the data. If the audio data ~~are~~ transmitted by the car radio 12 to the data sink 14 ~~3~~ are not compressed, the bit stream decoder 32 ~~6~~ will typically not need to be activated to decompress the audio data.

The data sink 14 ~~3~~ may contains an audio amplifier, which is connected via the interface 24 ~~4-3~~ to the optical data line 20~~5~~, to ~~and which~~ obtains the audio data directed to it ~~from this data line 5.~~ Depending on the control data transmitted with the audio data, the audio data may also be processed in the amplifier 14~~3~~. For example, this processing may includes equalization, application of a delay, or signal amplification, which are enabled/disabled by the control signals transmitted over the network 10. In the present example, the audio data compressed in the AC-3 format may be ~~are~~ transmitted by the car radio 12 via the optical data line 20 ~~5~~ through the subscriber 13 ~~2~~ to the amplifier 14~~3~~, where the audio data ~~and there~~ are decoded and decompressed by the AC-3 bit stream decoder 32~~6-3~~. Subsequently, the audio data may be ~~they are, among other things,~~ amplified~~,~~ and ~~then~~ provided ~~are conducted~~ to a pair of ~~the~~ loudspeakers 34, 36 ~~9, which are~~ connected to the amplifier 14~~3, of which two units are shown by way of example~~.

In addition to the car radio 12 ~~1~~, the local network 10 may include the ~~a~~ second data source 14 ~~2~~ such as a DVD player. The~~is~~ DVD player 13 may read from a DVD both audio and video data in compressed form, and may output the compressed audio and video data onto the data line 20 via its associated interface 23~~4 2~~. ~~Significantly, t~~ The DVD player 13 ~~2~~ can thus dispense with any kind of bit stream decoder because ~~, on the one hand,~~ the audio and video data may ~~are to~~ be transmitted in compressed form over the data line 20 ~~5~~ and ~~, on the other hand,~~ an appropriate decoder may be ~~is~~ situated centrally in the data sinks 14, 15 ~~3, 4~~ to play back the audio and video data. Thus, the DVD player 13 ~~2~~ can dispense with the expensive integrated circuits to decode the audio data ~~,~~ In the network 10, the audio data ~~which here~~ are present, for example, in the AC-3 format ~~,~~ while ~~and~~ the video data ~~, which here~~ are present, for example, as MPEG-2 data. This results in ~~is directly reflected in the form of a markedly~~ reduced cost ~~price~~ for the DVD player 13.

The compressed audio and video data from ~~of~~ the DVD player 13 may be ~~2 are~~ sent to the appropriate data sinks, which may include ~~can be, on the one hand,~~ the amplifier 13 ~~3~~ described above and ~~, on the other hand also~~ the display screen unit 15. ~~4.~~ In this configuration of the network 10, Only the display screen unit 15 is ~~4 needs to be~~ considered as a data sink for the video data. The display ~~unit 4~~ screen unit 15 includes the ~~an~~ interface 25, that ~~4 4, through which it is~~ connect~~s~~ed the unit 15 to the data line ~~5~~ 20. ~~on its input and output side,~~ The unit 15 may also include an MPEG-2 decoder 38 ~~6 4,~~ that decodes and thus decompresses the MPEG-2 coded video data transmitted to the display screen unit 15. ~~4,~~ The decoder 38 may also, ~~and,~~ for example, makes the data ~~them~~ available as uncompressed RGB signals to the display unit 15 (e.g., a TFT) for playing back the video data. The display screen unit 15 ~~4~~ may also includes a control unit 40~~7,~~ that ~~which on the one hand~~ controls the display screen unit 15 ~~4~~ by controlling the video data reproduction on a visual display ~~the~~ screen 42 ~~8~~ (e.g., its brightness, contrast, and hue). The control unit 40 may also ~~and on the other~~

~~hand~~ adapts the function of the bit stream decoder 38 ~~6-4~~ to the format of the input~~ted~~ video data. In this way, ~~on the one hand~~ the bit stream decoder 38 can either be turned off if non-coded video data are transmitted, or ~~, on the other hand,~~ an appropriate decoding function of the bit stream decoder can be chosen, in accordance with the incoming format (e.g., MPEG-1, MPEG-2, or the JPEG format). For example, MPEG-2 decoders can readily function as MPEG-1 decoders.

The control unit 40 ~~7 not only~~ can not only control the display screen unit 154, but can also control the local network 10 and particularly the data channels for transmitting the audio and/or video data between the particular data sources and ~~the particular~~ data sink.

Depending on the control unit 40 ~~7~~, the compressed audio data from the DVD player 13 ~~2~~ may be ~~are~~ conducted via the optical data line 20 ~~5~~ to the amplifier 14 ~~3~~ or to the display screen unit 154, which may have ~~has integrated~~ loudspeakers integrated into ~~its~~ the display screen unit housing. By way of example, ~~we shall assume that~~ the control unit 40 may ~~7 has~~ set an acoustic playback of the audio data through the amplifier unit 14~~3~~. In this case, the compressed audio data are received via the optical data line 20 ~~5~~ by the interface 24 ~~4-3~~ of the amplifier 14~~3~~, and are conducted to the AC-3 bit stream decoder 32 ~~6-3~~, which decodes and decompresses the compressed audio data and then conducts the uncompressed audio data to an ~~the~~ amplifier stage of the amplifier 14~~3~~. After the audio signals have been amplified, they are provided ~~conducted~~ to the loudspeakers 34, 36~~9~~.

The~~is~~ local network 10 therefore demonstrates ~~shows~~ how the data sources 12, 13 ~~1, 2~~ no longer each require a bit stream decoder, and how the bit stream decoders 32, 38 ~~6-3, 6-4~~ are assigned to the data sinks 14, 15 ~~3, 4,~~ which are centrally responsible for playing back the audio or video data. The example of the amplifier 14 illustrates ~~3 clearly shows~~ that it includes the ~~contains an~~ AC-3 decoder 32 ~~6-3~~ to decode the compressed audio data from the DVD player 13 ~~2~~ and also from the car radio 12, and that these decoded audio data subsequently are reproduced by the

loudspeakers 34, 369. Through this centralization and assignment of the bit stream decoders 32, 28 6-3, 6-4 to the corresponding data sinks 14, 15, the number of decoders can be greatly reduced. On the one hand, this noticeably reduces the costs of such a network 10 even with a small number of subscribers 12-15. With a large number of subscribers, especially with an increasing number of data sources 12, 13, 1, 2, the achievable cost advantage becomes continuously greater.

Furthermore, theis local network 10 exhibits the possibility of much more efficiently utilizing the maximum transmission capacity of the optical data line 205, since now many more parallel data channels can be transmitted simultaneously. Through this combination of improving the transmission efficiency together with a marked cost reduction, an especially advantageous local network 10 can has been created.

Such a network 10 is especially suited for use in an automobile, since in this application electromagnetic compatibility (e.g., the optical data line 205), ease of installation (e.g., a single data line 205), and relatively very low costs (e.g., reduction of the necessary bit stream decoders) with the same or greater functionality of the network 10 are achievableespecially important. This increased functionality becomes noticeable especially clear with the simultaneous transmission of several video data channels, since these channels typically have relatively large enormous data quantities. It should also be noted that it is precisely video applications which are becoming increasingly more and more important in automobiles, and consequently special attention must be paid to transmission efficiency together with adequate reliability for automotive use become of consideration.

Although the present invention has been illustrated and described with respect to several preferred embodiments thereof, various changes, omissions and additions to the form and detail thereof, may be made therein, without departing from the spirit and scope of the invention.

What is claimed is: